DOI:http://dx.doi.org/10.7314/APJCP.2016.17.1.225

RESEARCH ARTICLE

Psychometric Evaluation of the Colorectal Cancer Screening Belief Scale Based on Health Belief Model's Constructs for the Fecal Occult Blood Test

Rahim Tahmasebi[1], Azita Noroozi[2]*, Kamel Ghobadi Dashdebi[2]

Abstract

Background: It is important to validate scales related to cancer screening beliefs in order to better understand perceptions. The aim of this study was to test the psychometric properties of the colorectal cancer screening belief scale based on Health Belief Model (HBM) constructs. Materials and Methods: Data were collected from 600 persons referred to outpatient laboratory units in Iran through a convenience sampling procedure. In this cross-sectional study, exploratory and confirmatory factor analyses were used to examine construct validity of scale. Results: Through exploratory factor analysis, 52 items of the scale converged to five constructs of HBM with 4 items omission. Construct validity was determined by confirmatory factor analysis through which correlated model was supported. Cronbach's alpha coefficient for the whole scale was obtained as 0.78, which indicates reliability of the scale. Conclusions: The study findings showed that this scale is a valid and reliable instrument that can be used for measuring HBM constructs about colorectal cancer screening with the fecal occult blood test.

Keywords: Colorectal cancer screening beliefs - fecal occult blood test - health belief model - validity - Iran

Asian Pac J Cancer Prev, **17 (1)**, 225-229

Introduction

In the world wide, nearly 800,000 new colorectal cancer (CRC) cases occur each year, comprising 10% of all cancer malignancies with nearly 450,000 cases mortality annually. Totally, CRC is the fourth commonest form of cancer occurring worldwide (Boyle et al., 2000). Furthermore, cancer incidence data and death rate in Asians countries may be underestimated (U. S. Cancer Statistics Working Group. 2003).

When discovered early, CRC is highly treatable (Rawl et al., 2005), as 1-, 5-, and 10- year survival rates for persons diagnosed with early stage of CRC will be 82%, 61%, and 55%, respectively (Courneya et al., 2003). Cancer screening for colorectal cancer has been proven to be effective to early detection (U. S. Cancer Statistics Working Group, 2003). Screening with fecal occult blood tests (FOBT) will reduce mortality by over 30%. Current screening guidelines recommend that men and women with average risk should be regularly screened for CRC with yearly fecal occult blood testing (FOBT) (Rawl et al., 2005). However, Asians is the group least likely to receive cancer screenings of any kind (U. S. Cancer Statistics Working Group, 2003). According to American Cancer Society, only 14% of the Asians had a fecal occult blood test (FOBT) in the past year (American Cancer Society, 2006 ref1).

To design behavioral interventions in CRC screening, researchers need to identify perceptions to screening that are flexible (Tiro et al., 2005). Therefore it is important to develop and validate a CRC screening belief scale in order to better understand of perceptions (Hou, 2007).

Psychosocial constructs have been associated with CRC screening in the literature, however few studies have evaluated the psychometric properties of such measures (Mc Queen et al., 2008). Rawl assessed perceived benefits and barriers for specific CRC screening (Rawl et al., 2001). Hou evaluated the psychometric properties of three Psychosocial constructs include pros (perceived benefit), cons (perceived barriers), and perceived cancer risks (Hou, 2007). Tiro et al. conducted confirmatory factor analysis to confirm construct validity of five constructs (salience and coherence, perceived susceptibility, cancer worries, response efficacy, and social influence) (Tiro et al., 2005).

The Health Belief Model (HBM) is one of several psychosocial models developed to explain psychosocial constructs related to preventive health behavior such as cancer screening (Glanz et al., 2008). Four psychosocial constructs in this model were perceived susceptibility, perceived severity, perceived benefits, and perceived barriers. Other construct, self-efficacy, was later added to the original HBM. Jacobs adapted the Champion's Health Belief Model Scale, substituting colon cancer for breast cancer in the wording of the questions and Ozsoy

[1]*Biostatistics,* [2]*Health Education, Bushehr University of Medical Sciences, Bushehr, Iran* **For correspondence: azitanoroozi@yahoo.com*

evaluated validity and reliability of this scale for Turkish people. Ozsoy's scale obtained five structure factors which explained 48 per cent of the variance (Ozsoy et al., 2007).

Given the importance of having validated scale of psychosocial constructs, the purpose of this study was to test the psychometric properties of the combination of questions based on HBM's constructs. The specific objectives of the study are stated as:

1. Evaluating the colorectal cancer screening belief scale in terms of content, face, and construct validity; and internal consistency for Iranian people;

2. Evaluating cross- validation of colorectal cancer screening belief scale in Iranian people.

Materials and Methods

Research instrument:

The colorectal cancer belief scale, developed by combination of questions based on HBM's constructs in previous studies (Rawl et al., 2001; Tiro et al., 2005; Hou, 2007; Ozsoy et al., 2007). This scale included 52 items. All items were scored using a Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree), as higher ranking on the Likert scale indicates greater agreement with the health beliefs that were assessed.

Validity evaluation

Forward- backward translation, face validity, content validity, item analysis, and then construct validity performed for evaluation of validity.

Forward- backward translation: The first stage for psychometric evaluation consisted of translating the questionnaires published in English language based on Brislin method (Brislin, 1970). The researcher translated the all of scales based on HBM's constructs about colorectal cancer into Persian, and a person who was fluent in both Persian and English language, back-translated the questions into English. The process of forward–backward translation was used to obtain both semantic and cultural equivalences (Brislin, 1970). Then, researcher deleted questions with similar content, and two faculty members and the principle researcher evaluated the meaning equivalency between the original version and the back-translated version of the remaining questions. There was no significant difference between the two versions.

Content validity: For content validity, the 11 experts including 8 health education specialists and 3 nurses were asked to evaluate the items' relevance to colorectal cancer belief among Iranian people. Then, content validity ratio (CVR) was applied to assess the extent of the experts' agreement on the questions. The panel assessed each item using a 3-point Likert-type scale where 1 = essential, 2 = useful but not essential and 3 = unessential. The expert who rated each item as 3, was asked to provide his/her suggestions for modifying or eliminating it. In this study, no experts rated items as unessential. For a panel with 11 experts, a CVR score of .59 or higher indicates good content validity (Lawshe, 1975). CVR score for each question was equal to or more than .61 and total CVR score of 52 items was calculated .71 that was acceptable.

Face validity: The 50 participants were asked to explain each item for face validity. Participants guided the investigators as they made several minor adjustments to better reflect cultural matters especially in questions about barriers of FOBT performance.

Item analysis: An item analysis showed which items can be retained and which items should be deleted (Ferketich, 1991; Nunnally & Bernstein, 1994). An item was deleted if its mean score was greatly diverged from the total mean score of the scale, or its variance was close to 0, or correlation between each item's mean score and total item mean score of same construct was equal or above 0.3.

In this study, a pilot study conducted through using a convenience sample of 40 participants who were fluent in Farsi. The range of the mean score for the scale was from 2.88 (for perceived susceptibility) to 4.38 (for perceived severity) and the range of standard deviation score was from 0.63 (for perceived benefits) to 1.42 (for perceived severity). Item-total correlation coefficient was ranged from 0.15 (for perceived self- efficacy) to 0.81 (for perceived benefits). To avoid possible deletion of items that could be clinically significant in a larger sample, no items of the scale were deleted.

Construct validity: Exploratory and confirmatory factor analysis performed for construct validity. Exploratory factor analysis (EFA) was used to determine the number of latent factors (initially) or the pattern of relationships between the common factors. Confirmatory factor analysis (CFA) was used to confirm the model. The EFA, was done with SPSS version 18 and CFA was completed with LISREL 8.8.

To test whether the proposed model identified by the EFA fit the data, four types of statistical models were tested.

a) A one-factor model tested whether the scale could measure one overall factor, rather than individual beliefs. CFA support for this model would suggest that colorectal cancer beliefs are best represented by a unit-dimensional construct.

b) An uncorrelated factors model tests the idea that individual beliefs are independent or orthogonal. Support for this model would suggest that what is being measured in this study are independent constructs.

c) A correlated factors model tests the idea that individual beliefs are related to one another. Support for this model would suggest the possibility of a hierarchical model.

d) A hierarchical model tests the idea that a second-order factor can account for relations between individual beliefs. Support for this model would suggest that all factors are related to a higher-order factor. Retention of such a model would suggest that summing the total of the entire scale is appropriate and represents a meaningful and interpretable score.

The model fit criteria to assess model fit are Chi square, goodness-of-fit index (GFI), the adjusted goodness-of-fit index (AGFI), the root mean square error of approximation (RMSEA), the Bentler–Bonnet comparative fit index (CFI), the Bentler–Bonnet non-normed fit index (NNFI), and the Akaike Information Criterion (AIC). Model is fit if GFI value is greater than 0.9, AGFI greater than 0.8, RMSEA less than 0.08, and CFI and NNFI greater than

0.9. In this study, Expected Cross Validation Index (ECVI) used for evaluating cross- validate. Well-fitted models receive low values of ECVI and poorly fitted models receive high values. T value was used for elimination of parameters in CFA, and Modification Index (MI) was used for inclusion of additional parameters (Schumacker et al., 2004).

Reliability of the total scale and each factor was assessed with Cronbach's coefficient.

Results

Sample characteristics

In this study, participants were recruited from the Outpatient laboratory Unit through a convenience sampling procedure. The sample size was determined based on the ratio of the number of participants to the number of items of scale. Kline indicated that 10:1 is a realistic ratio of participants to items (Kline, 2005).

Table 1. Rotated factor analysis of Colorectal Cancer Screening Scale

Item	No	F1	F2	F3	F4	F5
Perceived susceptibility						
It is very likely I will get colorectal cancer in the future	1	0.558				
If one of my parents gets colorectal cancer, it increases my chance of getting colon cancer.	3	0.443				
It is possible for me to get cancer during my lifetime	5	0.468				
I will get colon cancer sometime during my lifetime	6	0.688				
Perceived severity						
If I develop bowel cancer is it likely that I will die	1		0.424			
Colon cancer treatment costs a lot to me and my family.	3		0.491			
Colorectal cancer makes me disabled	4		0.653			
Colorectal cancer affects the other organs of my body and cause severe complications	5		0.671			
colorectal cancer is serious if found late	6		0.565			
People with colon cancer will not have a normal life.	7		0.644			
Colorectal cancer is curable only if detected early.	8		0.472			
If I develop bowel cancer, My family will bother.	9		0.659			
If I develop bowel cancer I am certain that I would experience a lot of physical pain	10		0.71			
If I develop cancer it is likely that my financial security and social life would be at risk	11		0.714			
If I develop bowel cancer, my life will be difficult.	12		0.729			
Colorectal cancer would threaten a relationship with my spouse	13		0.554			
Colorectal cancer is an unpromising disease.	14		0.572			
Problems I would have with colorectal cancer would last a long time	15		0.656			
Perceived barriers						
Unless I have symptoms or feel uncomfortable, I will not go screening	2			0.482		
Do not know how to do a stool blood test	3			0.453		
I am afraid of having an abnormal colorectal cancer screening test result	4			0.586		
Do not have time to do a stool blood test	5			0.591		
I do not know where test FOBT.	6			0.593		
Having regular check-ups to find colorectal cancer will cost too much money	7			0.591		
Health care provider never recommended stool blood test	8			0.437		
I think if someone is meant to have colon cancer, they will have colon cancer.	9			0.564		
I do not want to know if I have cancer	10			0.588		
Collecting a stool sample is unpleasant	11			0.58		
Stool blood test is embarrassing	12			0.495		
If someone gets colon cancer, whether they find it early or late, they will still die from it.	13			0.539	-0.401	
There is no test to find colon cancer early	14			0.546		
Problems with transportation	15			0.574		
I would forget to do FOBT.	16			0.579		
I have more important problems than the test for colorectal cancer detection.	17			0.546		
Perceived benefits						
Doing an FOBT would reduce my chances of dying from bowel cancer				1	0.647	
With annual FOBT can be aware of my health.				2	0.642	
Having a FOBT will help me find colon cancer early				3	0.721	
If colon cancer is detected early, chances of cures are very high				4	0.717	
With the early detection of colorectal cancer, the treatment will be easier.				5	0.721	
Understanding that when polyps are found and removed, cancer can be prevented				6	0.695	
The benefits of FOBT outweigh any difficulty I might have in going through the tests				7	0.575	
I believe that FOBT is an effective way to find colorectal cancer early				8	0.551	
Perceived self-efficacy						
If I am invited to do an FOBT, I believe that I would be able to do it				1		0.76
Despite family opposition, I believe that I would be able to do FOBT.				2		0.782
Even if I'm nervous about cancer, I believe that I would be able to do it				3		0.753
I am sure that I could follow healthy eating for preventing colorectal cancer				4		0.658
I can recognize normal and abnormal changes in my bowel habits				5		0.742
I would be able to help my doctor to early diagnosis and treatment, With the annual FOBT.				6		0.713

From the total of 612 patients, 12 participants submitted imperfect data in the questionnaire, so they were excluded from the study. The final sample included in the analysis was 600, yielding a 98% response rate. Of these, 48.2% (289) were males and 51.8% (311) females. Most of the participants 63.5% (n = 381) had education of the primary/ secondary level, 27.2% (n = 163) had graduated from high school, and 9% (n = 54) had obtained a college degree. Most of the participants in this study had not a family history of cancer (67%, N= 402). The history of Gastro- intestinal disease reported in 42% (N= 252) of participants. Of all 600 participants, 29.9% (n = 179) performed FOBT.

Construct validity

Exploratory Factor Analysis: The Kaiser–Meyer–Olkin measure of sampling adequacy was 0.89, showing the sample was large enough to perform a satisfactory factor analysis. Bartlett's test of sphericity was significant ($\chi^2 = 12467.2$, df = 1326, P = 0.000), indicating that there were some relationships among the items.

Varimax rotation procedures were used to rotate the factors. To examine the data via rotated factor analysis, investigators set the criteria of eigenvalue at a minimum of 1, minimum factor loading of .40, and a maximum of 25 rotation iterations (Costello et al., 2005). Factor analysis rotation converged at six iterations. In this study, the principal component analysis revealed five factors with an Eigenvalue >1, explaining 56.03% of the total sample variance.

Four items (item 2 and 4 of perceived susceptibility, item 2 of perceived severity, and item one of perceived barrier) omitted in this stage. One item (item 13 of perceived barrier) had cross loading. To avoid unsuitable omission of items, this item that loaded in two factors weren't deleted in this stage. All loaded items in factors were based on HBM's constructs. The factor loadings and factor structure resulting from factor analysis through varimax rotation are shown in table 1.

Confirmatory factor analysis

Confirmatory factor analysis (CFA) was applied to construct validity. Mardia's coefficients for multivariate skewness and kurtosis were estimated to be 101.86. As this value was significant, robust maximum likelihood estimation procedures was used in this study. A covariance matrix and asymptotic covariance matrix were applied to estimate model.

In this stage, four models including one-factor model, uncorrelated factor model, correlated factor model, and hierarchical model were examined. Expectedly, the correlated model compared to uncorrelated model and one-factor model fitted more properly. Also, the correlated model compared to hierarchical model fitted more properly. Based on the fit index especially the reduction of the AIC, and ECVI value we determined this scale with 48 items and five correlated constructs had stronger factorial validity.

The overall fit indices of correlated model did not reach the criteria of proper fit, therefore this model modified. In accordance with EFA, item 13 of perceived barrier could be loaded in perceived benefit too, whereas according to CFA considering T-value this item was deleted from perceived benefit.

To improve the correlated model, the modification index and t values were applied. According to the highest modification index and conceptual meaning, three pair of error covariance added to the correlated model between items 4 and 5 of perceived severity, items 1 and 2 of self-efficacy, and items 13 and 14 of perceived barrier.

Standardized factor loading in all factors ranged from .31 to .81 which was statistically significant ($p < 0.001$). Furthermore all residual or error variances ranged from .32 to .87 and were statistically significant ($p < 0.001$). Perceived susceptibility had significant correlation only with perceived severity ($p < 0.001$). The correlation between the perceived severity and perceived barrier was not significant ($p = 0.06$). The correlation between other factors, were significant ($p < 0.001$).

Reliability

After confirming factors structures, Cronbach's coefficient alpha was used to assess internal consistency reliability of the total scale and each factor separately in total sample (n = 600). In this regard, Cronbach's coefficient alpha were .69, .87, .87, .89, and .90 for factors perceived susceptibility, perceived severity, perceived barriers, perceived benefits, and perceived self-efficacy respectively and 0.78 for total scale.

Discussion

The objective of this study was to evaluate the validity and reliability of the colorectal cancer screening belief scale among the Iranian population. According to the results of the present study, the items were homogenous to the scale; as the mean and variance scores of each item and item total correlation confirmed this homogeneity. These convergence evidence from current data demonstrated that the structure of the colorectal cancer screening belief scale was consistent to the theoretical constructs of Health Belief Model with satisfactory reliabilities and validities.

Construct validity of the scale was assessed through exploratory and confirmatory factor analysis, but in

Table 2. Fit Index Confirmatory Factor Analysis of Subfactors in Colorectal Cancer Screening Scale

Model	x^2	RMSEA	NNFI	AGFI	ECVI	AIC	x^2:df
One factor model	12466.08	0.133(0.12-0.13)	0.65	0.43	21.13	12658.08	11.54
uncorrelated model	3798.34	0.065 (0.063- 0.067)	0.92	0.74	6.66	3990.34	3.52
correlated model	3336.51	0.059 (0.057- 0.062)	0.93	0.76	5.92	3548.51	3.12
hierarchical model	3637.92	0.060 (0.058- 0.062)	0.93	0.75	6.66	3584.74	3.38
Final correlated model	3032.15	0.055(0.053-0.058)	0.94	0.8	5.43	3250.15	2.81

Ozsoy's study only EFA was performed for construct validity (Ozsoy et al., 2007). In psychometric stage by EFA, results show that the scale accounted for 56.03% of the variance in the total scores. This rate was better than 48% reported in Ozsoy's study (Ozsoy et al., 2007).

Similar to this study, Ozsoy also report five factors for scale. In this study five factors consisted perceived susceptibility, severity, barriers, benefits and self- efficacy which are main constructs of HBM, but in Ozsoy's study five factors were perceived susceptibility, severity, barriers, self- efficacy, and health motivation, and there was not perceived benefit questions in Ozsoy's scale (Ozsoy et al., 2007).

As Nunnally and Bernstein demonstrated, EFA should not be used to confirm factor structure because EFA is a data-driven method for exploring the factor structure of a set of variables (Nunnally & Bernstein, 1994). Therefore, CFA was applied to confirm factor structure. In CFA, correlated model with three pair of error covariance fitted more than the hierarchical model. It shows that summing the total of the entire scale is not appropriate and does not represent a meaningful score and each construct must be evaluated separately, but they are related to one another.

Although perceived barriers, perceived benefits and self-efficacy are conceptually distinct, they were correlated with each other. Perceived susceptibility was only correlated to perceived severity that was consistent to the theoretical construct of Health Belief Model as titled perceived threat.

Reliability of the Iranian version of colorectal cancer screening belief scale was appropriate with a value of .78 for the total scale and ranged from .69 to .90 for the subscales, which is appropriate (Jacobson, 2004). Devellis suggested that alpha coefficients greater than .90 may indicate the need to shorten the instrument length (DeVellis, 1991), therefore 48 items are appropriate for evaluating five subscales of colorectal cancer screening belief. In Ozsoy's study, Cronbach's coefficient alpha in two factors includes health motivation and perceived severity was lower than 0.6 which is not appropriate (Jacobson, 2004).

Nevertheless, the use of convenience sampling may be thought to limit generality of the findings, but the results could be of major importance and significances to the Iranian people.

In summary, current study indicated that the colorectal cancer screening belief scale is reliable and valid for assessing beliefs towards cancer screenings with FOBT among Iranian population. It provides a multidimensional measurement to assess colorectal cancer screening related beliefs with FOBT. It is recommended that this scale be further evaluated in different regions in Iran and diverse populations of world.

Acknowledgements

This paper is retrieved from MSc thesis in health Education of Bushehr University of Medical Sciences in Iran. We gratefully acknowledge them and all persons who helped us in this research.

References

American Cancer Society (2006). Cancer prevention and early detection facts & figures 2006. Atlanta, GA: American Cancer Society.

Brislin RW (1970). Back-translation for cross-cultural research. *J Cross Cult Psychol*, **31**, 185-216.

Boyle P, Langman JS (2000). ABC of colorectal cancer: Epidemiology. *BMJ*, **321**, 805-8.

Costello AB and Osborne JW (2005). Best practices in exploratory factor analysis: Four recommendations for getting the most from your analysis. *Pract Assess Res Eval*, **10**, 1-9.

Courneya KS, Friedenreich CM, Quinney HA, et al (2003). A randomized trial of exercise and quality of life in colorectal cancer survivors. *Eur J Cancer Care*, **12**, 347-57.

DeVellis RF (1991). Scale development : theory and applications. Newbury Park ; London: Sage.

Ferketich S (1991). Focus on psychometrics. Aspects of item analysis. *Res Nurs Health*, **14**, 165-8.

Glanz K, Rimer BK, Viswanath K (2008). Health behavior and health education: theory, research, and practice. 4th ed. San Francisco: John Wiley & Sons.

Hou SI (2007). Cancer Screening Belief Scale – Chinese Version (CSBS-C): Validation on scale psychometric properties among a Chinese worksite population. *Calif J Health Promot*, **5**, 79-88.

Jacobson SF (2004). Evaluating instruments for use in clinical nursing research. In Marilyn F, Sharon JO. Instruments for Clinical Health-Care Research (pp. 73-80). London: Jones and Bartlett.

Kline RB (2005). Principles and practice of structural equation modeling 2nd ed. New York: Guilford.

Lawshe CH (1975). A quantitative approach to content validity. *Pers Psychol*, **28**, 563-575.

McQueen A, Tiro JA, Vernon SW (2008). Construct validity and invariance of four factors associated with colorectal cancer screening across gender, race, and prior screening. *Cancer Epidemiol Biomarkers Prev*, **17**, 2231-7.

Nunnally JC, Bernstein IH (1994). Psychometric Theory. New York: McGraw-Hill Inc.

Ozsoy SA, Ardahan M, Ozman D (2007). Reliability and validity of the colorectal cancer screening belief scale in Turkey. *Cancer Nurs*, **30**, 139-45.

Rawl SR, Champion VL, Menon U, et al (2001). Validation of scales to measure benefits and barriers to colorectal cancer screening. *J Psychosoc Oncol*, **19**, 47-63.

Rawl SM, Menon U, Champion VL, et al (2005). Do benefits and barriers differ by stage of adoption for colorectal cancer screening? *Health Educ Res*, **20**, 137-48.

Schumacker RE, Lomax RG (2004). A beginner's guide to structural equation modelling. 2nd ed. London: Lawrence Erlbaum Associates.

Tiro JA, Vernon SW, Hyslop T, Myers RE (2005). Factorial validity and invariance of a survey measuring psychosocial correlates of colorectal cancer screening among african americans and caucasians. *Cancer Epidemiol Biomarkers Prev*, **14**, 2855-61.

United States cancer statistics: 2000 incidence (2006). Atlanta, GA: Department of health and human services, centers for disease control and prevention and national cancer institute. From http://www.cdc.gov/cancer/npcr/uscs/pdf/2002_USCS.pdf